

$$F_{fs} = \mu_s F_N$$

μ_s = coefficient
of static
friction

$$F_{fk} = \mu_k F_N$$

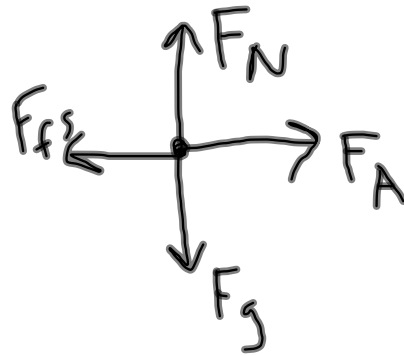
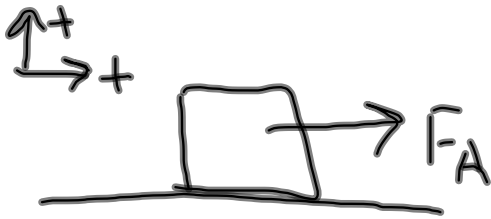
μ_k = coefficient
of kinetic
friction

μ_s and μ_k are
Unitless quantities

$$\mu_s > \mu_k$$

Force of Friction Notes and Practice Problems 1st Block 9.19.11

A 24 kg crate initially at rest on a horizontal floor requires a 75 N horizontal force to set it in motion. Find the coefficient of static friction between the crate and the floor.



$$F_{fs} = \mu_s F_N$$

$$\begin{aligned}\mu_s &= \frac{F_{fs}}{F_N} \\ &= \frac{75 \text{ N}}{235.2 \text{ N}} \\ &= .319\end{aligned}$$

$$\sum \bar{F}_x = 0$$

$$\begin{aligned}F_A - F_{fs} &= 0 \\ F_A &= F_{fs} = 75 \text{ N}\end{aligned}$$

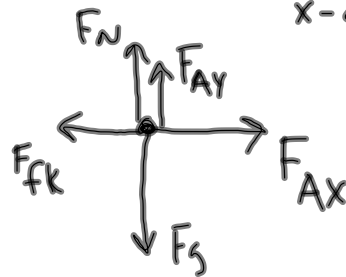
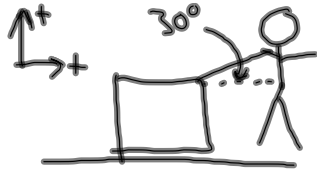
$$\sum \bar{F} = 0$$

$$F_N - F_g = 0$$

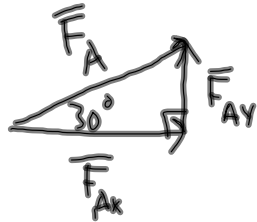
$$\begin{aligned}F_N &= F_g \\ &= m a_g \\ &= (24 \text{ kg})(9.8 \text{ m/s}^2) \\ &= 235.2 \text{ N}\end{aligned}$$

Force of Friction Notes and Practice Problems 1st Block 9.19.11

A student attaches a rope to a 20.0 kg box of books. He pulls with a force of 90.0 N at an angle of 30.0 degrees with the horizontal. The coefficient of kinetic friction between the box and the sidewalk is 0.500. Find the acceleration of the box.



In the x-direction



$$F_{Ax} = F_A \cos(30^\circ) = 77.9 \text{ N}$$

$$F_{Ay} = F_A \sin(30^\circ) = 45.0 \text{ N}$$

$$\Sigma \vec{F}_x = m \vec{a}_x$$

$$\Sigma F_x = F_{Ax} - F_{fk}$$

$$a_x = \frac{\Sigma F_x}{m}$$

$$= \frac{2.4 \text{ N}}{20.0 \text{ kg}}$$

$$= 0.122 \text{ m/s}^2$$

$$= 77.9 \text{ N} - 75.5 \text{ N} = 2.4 \text{ N}$$

$$F_{fk} = \mu_k F_N$$

$$= (0.5)(151 \text{ N}) = 75.5 \text{ N}$$

$$\Sigma \vec{F}_y = 0$$

$$F_N + F_{Ay} - F_g = 0$$

$$F_N = F_g - F_{Ay}$$

$$= 196 \text{ N} - 45 \text{ N}$$

$$= 151 \text{ N}$$

Quiz Wed., 9/21

HW: P. 134: 1, 4

P. 137: 35, 37

A box of books weighing 325 N moves at a constant velocity across the floor when the box is pushed with a force of 425 N exerted downward at an angle of 35.2 degrees below the horizontal. Find μ_k between the box and the floor.

A 55 kg ice skater is at rest on a flat skating rink. A 198 N horizontal force is needed to set the skater in motion. However, after the skater is in motion, a horizontal force of 175 N keeps the skater moving at a constant velocity. Find the coefficients of static and kinetic friction between the skates and the ice.